8 March 1961

STAFF STUDY: CHEMICAL STORAGE SYSTEM

1. DEFINITION OF THE PROBLEM

The problem of supplying photographic processing solutions to a number of processing stations situated within a laboratory has been studied by members of the TD/SS Staff. On 29 April 1960, the undersigned prepared a report to the Chief, TISD, the subject of which was Chemical Replenishment System for the DMD Photographic Laboratory. This report was written after having visited several photographic laboratories, both military and civilian. The so-called Tank Farm operated by these laboratories was, without exception, designed to accommodate the chemical requirements for a continuous operation involving a few standard items. These chemicals were stored in rather large quantities, piped to processing stations where they were used in a continuous type processor, returned to storage after use where they were analyzed and replenished, and finally returned to bulk storage. This particular method has many advantages when there is a continuous requirement. The photographic laboratory at PIC does not have a continuous processing requirement and, based on this fact alone, an alternate method is now proposed.

2. ASSUMPTIONS

Based on past history and records of the DMD Laboratory, there has been virtually no requirement for a continuous film processing operation. It is, therefore, assumed that this operation will continue to be an intermittent one in the future, even though expanded when incorporated into the National Center. It is also assumed that the rapid and economical supply of photographic chemical solutions of accurately-known values will be a future requirement. It is further assumed that any method proposed must meet certain basic specifications, which are: (A) economy of operation; (B) reliability and consistency of chemical solutions; (C) simplicity of design; (D) immediate access; (E) low maintenance cost; (F) flexibility in changing formulae.

3. FACTS BEARING ON THE PROBLEM

In all known photographic installations there have been only two basic methods of chemical supply observed. One of these is previously described in Paragraph 1 above. The other variation on this theme is the mixing of fairly large batches of processing solutions from prepared dry chemical formulae. These pre-packaged chemicals are brought into

solutions by dissolving them in water at 125° F., allowing them to assume operating temperatures which are generally in the 70° range, and finally piping them to the various processing stations where they are used during their normal life expectancy and subsequently discarded. This method is not only laborious and time consuming but allows virtually no flexibility regarding the developer formulae.

4. DISCUSSION OF THE FACTS

Since neither method, 1 or 2 above, meet all or most of the requirements previously set forth, it is propitious to suggest an alternate method. Preliminary investigation of this new method discloses that it is both novel and sound for our particular requirements. There are 5 basic ingredients to all photographic developers: (1) a reducing agent; (2) an accelerator; (3) a restrainer; (4) a preservative; and (5) an alkali. The amounts and balances of these basic ingredients are varied to suit a specific requirement based on a photographic emulsion. All of these basic ingredients are readily soluble to a 50 percent state of saturation. These ingredients, when stored separately, have excellent keeping qualities and a low rate of oxidation. These ingredients, when purchased as bulk chemicals, cost but a fraction of the price of compounded developer solutions. Since the bulk ingredient of all of these formulae is water, a 50 gallon batch of 50 percent saturated Metol will make more than 77,000 gallons of a developer solution. From this fact it is almost needless to point out that the frequency of mixing these basic ingredients would be extremely low. Photographic paper and film require different fixing agents, and therefore, it is proposed that two types of fixing baths be stored in 300 gallon containers. It is also proposed that 50 gallon batches of the five basic ingredients be stored in a 50 percent saturated solution. These five basic ingredients would be piped to a central 100 gallon mixing vat and, since the chemicals are in solution, the compounding of a developer formula would be extremely rapid and effortless. The task would be reduced to consulting a card file for the proper number of ounces of each saturated solution to be combined with the necessary number of gallons of water to make the required number of gallons of developer solutions. It is unnecessary to point out that these chemicals would all be at working temperatures and no delay would be encountered between mixing and using of these solutions. It is important to mention that a large variety of formulae could be supplied to the various processing stations with only a few moments delay. These solutions would be used during their normal life and discarded, with the possible exception of the fixing bath for film. This solution could be returned to a silver recovery and then put back into storage. Attached is a list of five well-known developer formulae, using the aforementioned basic ingredients, and will serve to illustrate their universal application. Due to the rapid access of these developer formulae, only the required number of gallons of each solution would be prepared for distribution to the processing stations each day. Only a short notice of any

program changes would be required to evacuate and refill any of the processing stations. Since all of these solutions would be compounded from known basic elements, there would be no variety in results, and an extremely high degree of quality control would be achieved.

5. CONCLUSIONS

The method, or system, described in item 4 above meets all of the specifications as stated in Paragraph 2 of this study, namely: (A) economy of operation; (B) reliability and consistency of chemical solutions; (C) simplicity of design; (D) immediate access; (E) low maintenance cost; (F) flexibility in changing formulae. This method is also unique in that it lends itself to an intermittent type operation with maximum economy and efficiency.

6. RECOMMENDATIONS FOR ACTION

It is recommended that the undersigned be directed by the TDE to discuss this method with personnel of D&M in order that this method might be incorporated in the planning for the new building. It is further recommended that small amounts of these saturated solutions be submitted to the U.S. Bureau of Standards and/or private chemical research organizations for testing and feasibility studies. It is also recommended that the method described be discussed with hardware specialists in this field (such as [redacted], to arrive at the ultimate in simplicity of design. STATINTL

[redacted] STATINTL
Chief, TISD

STATINTL PIC/TISD:[redacted]

Attachment: 1

Comparison of Standard Developers